

Claim Amendments

1. (currently amended) A variable phase shifter module, comprising:
a first main PCB having an input trace coupled to a first wiper junction;
a first arcuate trace extending between a first output trace and a second output trace on the first main PCB, the first arcuate trace having an arc center proximate the first wiper junction; and
a first wiper PCB having a linking trace thereon; the first wiper PCB rotatably coupled to the first main PCB proximate the first wiper junction with the linking trace facing the first main PCB; the linking trace coupling the first wiper junction with the first arcuate trace; and
an arcuate edge guide surface formed in the first main PCB having an arc center proximate the first wiper junction; and a clip coupled to the first wiper PCB to bias the first wiper PCB against the first main PCB about the arcuate edge guide surface.

2. (original) The apparatus of claim 1, further including a second arcuate trace extending between a third output trace and a fourth output trace; the second arcuate trace having an arc center proximate the first wiper junction.

3. (original) The apparatus of claim 1, further including a fifth output trace coupled to the first wiper junction.

4. (canceled)

5. (currently amended) The apparatus of claim 1, further including A variable phase shifter module, comprising:
a first main PCB having an input trace coupled to a first wiper junction;
a first arcuate trace extending between a first output trace and a second output trace on the first main PCB, the first arcuate trace having an arc center proximate the first wiper junction;

a first wiper PCB having a linking trace thereon; the first wiper PCB rotatably coupled to the first main PCB proximate the first wiper junction with the linking trace facing the first main PCB;
the linking trace coupling the first wiper junction with the first arcuate trace; and
an arcuate guide slot formed in the first main PCB having an arc center proximate the first wiper junction; and a fastener extending through the guide slot and a guide hole formed in the first wiper PCB to bias the first wiper PCB against the first main PCB.

6. (previously presented) The apparatus of claim 1, wherein the first output trace and second output trace have a width and length selected to provide a desired power division and pre-set phase shift differential.

7. (original) The apparatus of claim 1, wherein one of the first main PCB, the first wiper PCB and both of the first main PCB and the first wiper PCB have a dielectric coating.

8. (currently amended) The apparatus of claim 1, further including A variable phase shifter module, comprising:
a first main PCB having an input trace coupled to a first wiper junction;
a first arcuate trace extending between a first output trace and a second output trace on the first main PCB, the first arcuate trace having an arc center proximate the first wiper junction;
a first wiper PCB having a linking trace thereon; the first wiper PCB rotatably coupled to the first main PCB proximate the first wiper junction with the linking trace facing the first main PCB;
the linking trace coupling the first wiper junction with the first arcuate trace; and
a second main PCB with a second wiper PCB coupled proximate a second wiper junction;
the second wiper pcb rotatably coupled to the second main PCB printed circuit board proximate the second wiper junction;
the first wiper junction and the second wiper junction aligned in a spaced apart coaxial orientation;

the first wiper PCB and the second wiper PCB coupled together by a linkage pin at a spaced apart location from the first wiper junction joining a first clip, coupled to the first wiper to bias the first wiper PCB against the first main PCB, to a second clip, coupled to the second wiper to bias the second wiper PCB against the second main PCB.

9. (canceled)

10. (canceled)

11. (original) The apparatus of claim 8, further including a base plate to which the first PCB and second PCB are coupled; a trace side of the first PCB and of the second PCB each facing the baseplate.

12. (original) The apparatus of claim 8, further including a base plate to which the first PCB and second PCB are coupled; a trace side of the first PCB and of the second PCB arranged facing away from each other.

13. (original) The apparatus of claim 8, further including an arcuate edge guide surface formed in the first main PCB having an arc center proximate the first wiper junction; and a clip coupled to the wiper to bias the wiper against the first main PCB, about the arcuate edge guide surface.

14. (original) The apparatus of claim 1, wherein the wiper PCB has an epoxy glass substrate.

15. (original) The apparatus of claim 1, wherein the wiper PCB has a linkage slot formed in a distal end.

16. (previously presented) A variable phase shifter module, comprising:
 - a first main PCB having an input trace coupled to a first wiper junction;
 - a first arcuate trace extending between a first output trace and a second output trace on the first main PCB, the first arcuate trace having an arc center proximate the first wiper junction;
 - a second arcuate trace extending between a third output trace and a fourth output trace; the second arcuate trace having an arc center proximate the first wiper junction; a first wiper PCB having a linking trace thereon; the first wiper PCB rotatably coupled to the first main PCB proximate the first wiper junction with the linking trace facing the first main PCB; and an arcuate edge guide surface formed in the first main PCB having an arc center proximate the first wiper junction; and a clip coupled to the wiper to bias the first wiper PCB against the first main PCB, about the arcuate edge guide surface;
 - the linking trace coupling the first wiper junction with the first arcuate trace and the second arcuate trace.
17. (original) The apparatus of claim 16, further including a second main PCB with a second wiper PCB coupled proximate a second wiper junction;
 - the wiper rotatably coupled to the second printed circuit board proximate the second wiper junction;
 - the first wiper PCB and the second wiper PCB coupled together;
 - the first wiper junction and the second wiper junction aligned in a spaced apart coaxial orientation.
18. (original) The apparatus of claim 17, further including a base plate to which the first PCB and second PCB are coupled; a trace side of the first PCB and of the second PCB each facing the baseplate.

19. (original) The apparatus of claim 17, further including a base plate to which the first PCB and second PCB are coupled; a trace side of the first PCB and of the second PCB arranged facing away from each other.

20. (original) The apparatus of claim 16, further including a linkage slot formed in the distal end of the first wiper PCB.

21. (withdrawn) A low-height panel antenna comprising:
an array of radiating elements;
a feed network connecting a signal input to said array of radiating elements; and
a phase shifter assembly located in said feed network and configured to adjust the phasing of signals fed to said array of radiating elements, said phase shifter assembly comprising a moveable conductive component coupled to the input and capacitively coupled to a transmission line segment of the network between radiating elements, the wiper conductive component or transmission line segment having a dielectric coating providing dielectric separation of the transmission line segment and the wiper conductive component.

22. (previously presented) The apparatus of claim 16 wherein the linking trace is located on a side of the first wiper PCB facing the first arcuate trace.

23. (withdrawn) The antenna of claim 22 wherein said transmission line segment is configured as a segment of a circle and wherein said wiper body is pivoted at the center of the circle.

24. (withdrawn) The antenna of claim 22 wherein said wiper body includes an extension adapted for coupling to a phase shifter adjustment linkage.

25. (previously presented) The apparatus of claim 7 wherein said dielectric coating is composed of soldermask or an organic compound.

26. (withdrawn) A low-height phase shifter assembly adapted to adjust the phasing of signals fed through a transmission line network to an array of antenna radiating elements, said phase shifter assembly having a moveable wiper comprising a dielectric substrate with a conductive layer on a surface of the substrate facing and spaced from a segment of the transmission line.

27. (withdrawn) The phase shifter assembly of claim 26 wherein said dielectric substrate comprises a PC board and said conductive layer is a trace formed on the said surface of the PC board.

28. (previously presented) The apparatus of claim 22 wherein said linking trace has a coating composed of dielectric material.

29. (previously presented) The apparatus of claim 28 wherein said dielectric coating comprises soldermask or organic material.

30. (withdrawn) The phase shifter assembly of claim 26 wherein said dielectric substrate is configured to be coupled to a phase shifter adjustment linkage.

31. (withdrawn) A low-height panel antenna comprising:
an array of radiating elements;
a feed network connecting a signal input to said array of radiating elements; and
a low-height phase shifter assembly as described in claim 200 located in said feed network and configured to adjust the phasing of signals fed to said array of radiating elements.

32. (withdrawn) The panel antenna of claim 31 including a predetermined plurality of arrays of radiating elements, and a corresponding plurality of said phase shifter assemblies arranged in a stack to control signal phasing in said plurality of arrays of radiating elements.

33. (withdrawn) The panel antenna of claim 31 having a coupling arrangement configured to couple said plurality of phase shifter assemblies together and to a phase shifter adjustment linkage such that movement of the linkage moves said plurality of phase shifter assemblies together as one unit.

34. (withdrawn) A low-height phase shifter assembly adapted to adjust the phasing of signals fed through a transmission line network to an array of antenna radiating elements, said phase shifter assembly comprising a moveable conductive component coupled to a signal input and capacitively coupled to a segment of the transmission line network between radiating elements, the wiper conductive component or transmission line segment having a dielectric coating providing dielectric separation of the transmission line segment and the wiper conductive component.

35. (withdrawn) The phase shifter assembly of claim 34 wherein said moveable conductive component comprises a conductive trace on a PC board wiper body, the trace being located on the side of the wiper body facing the transmission line segment.

36. (withdrawn) The phase shifter assembly of claim 35 wherein said transmission line segment is configured as a segment of a circle and wherein said wiper body is pivoted at the center of the circle.

37. (withdrawn) The phase shifter assembly of claim 35 wherein said wiper body includes an extension adapted for coupling to a phase shifter adjustment linkage.

38. (withdrawn) 37. The phase shifter assembly of claim 34 wherein said dielectric coating is composed of soldermask or organic material.

39. (withdrawn) A low-height panel antenna comprising:
an array of radiating elements;
a feed network connecting a signal input to said array of radiating elements; and
a low-height phase shifter assembly as described in claim 300 located in said feed network and configured to adjust the phasing of signals fed to said array of radiating elements.

40. (withdrawn) The panel antenna of claim 39 including a predetermined plurality of arrays of radiating elements, and a corresponding plurality of said phase shifter assemblies arranged in a stack to control signal phasing in said plurality of arrays of radiating elements.

41. (withdrawn) The panel antenna of claim 39 having a coupling arrangement configured to couple said plurality of phase shifter assemblies together and to a phase shifter adjustment linkage such that movement of the linkage moves said plurality of phase shifter assemblies together as one unit.